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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 09/993,496 | 11/27/2001 | Tae-Duk Kim | 1594.1017 | 8100 |

21171 7590 06/28/2005

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| EXAMINER | |
|---|---|
| SAYOC, EMMANUEL | |
| **ART UNIT** | **PAPER NUMBER** |
| 3746 | |

DATE MAILED: 06/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 09/993,496 | KIM, TAE-DUK | |
| | Examiner | Art Unit | |
| | Emmanuel Sayoc | 3746 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *25 April 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *3-5,11,12,22,25 and 26* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *3,4,and 11* is/are allowed.

6)☒ Claim(s) *5,22,25 and 26* is/are rejected.

7)☒ Claim(s) *12* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *2/14/2003* is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

1. This office action is in response to the amendments of 4/25/2005. In making the below rejections and/or objections the examiner has considered and addressed each of the applicants arguments. Claims 3-5, 11, 12, 22, 25 and 26 are pending, and are under current consideration. Claims 11, 12, and 22 are amended. Claims 1, 2, 6-10, 13-21, 23, 24 and 27 have been cancelled.

### *Claim Recommendations*

2. In Claim 22, line 9, in the phrase "according to the determining," the examiner recommends the phrase to be changed to "according to the determination".

### *Claim Objections*

3. Claim 12 is objected to because of the following informalities: in claim 12, line 12, the phrase "penetrating the first and second coil" is unclear in context. Appropriate correction is required.

For this office action, the phrase is interpreted to be that the core passes back and forth relative to the coils, as opposed to a physical penetration of the coil boundaries.

***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 5, 22, 25, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yamamoto et al. (U.S. Pat. 5,897,296), and in further view of Heymans et al. (U.S. 4,772,828).

Yamamoto et al. in Figures 1 and 4, disclose a control apparatus for a linear compressor comprising a collision detection unit (generally shown in Figure 1) for detecting collision of a piston (12a) with a valve (Figure 1 shown not enumerated, Figure 4, embodiment 15, 16), and a driving force control section (16a, see column 4 lines 5-25 computer processing and calculation) for determining whether the collision of the piston occurs on the basis of an output signal from the collision detection unit (Figure 1) – see abstract, column 3 lines 1-44, column 5 lines 3-20, column 6 lines 22-42, column 9 lines 5-52, and column 11 lines 5-29. The apparatus includes a displacement detecting section (14a) for determining the position of the piston, and an upper dead point position (peak amplitude) detecting section (15a) for detecting the pistons upper dead point position, which is compared to a preset upper dead point reference valve (31). This displacement detecting section (14a) produces signals relative to the pistons position. It is evident that given the position of the piston, the

processors in this section calculate not only the displacement of the piston, but also the amplitude of the piston at any given sampling instance.

The driving force control section (16a) is analogous to the claimed inventions control unit, and it resets the maximum amplitude data of the piston of the linear compressor when collision occurs – see column 9 lines 6-52, and column 11 lines 5-39. The control apparatus further comprises a compressor-driving unit (13a) for controlling the maximum amplitude of the piston of the linear compressor under the control of the driving force control section (16a).

The collision control apparatus of Yamamoto et al. is designed to prevent collision and damage of the intake valve (15) and the ejector valve (16) in the cylinder (11) due to the collision of the piston (12a) with the top of the cylinder (11) – see column 15 lines 51-53.

The control circuit of the Yamamoto et al. apparatus comprises an amplitude control means (30) primarily consisting of an amplifier (32) which compares an upper dead point position signal from the upper dead point position calculation means (28) with an upper dead point reference value (31) stored in memory in the inverter control means (29) and changes an output voltage amplitude for the base drive circuit (26) in proportion to a difference between them - see column 10 lines 43-58.

The reciprocating assembly, which consists of the piston (12a, also see Figure 4, 14, 13) and moving armature assemblies, constitutes a core.

The Yamamoto et al. device differs from the claimed invention in that there is no explicit teaching that output signals from energized coils are inputted into a differential

amplifier, and the piston amplitude and therefore the displacement is calculated based on the output signal from a differential amplifying unit.

Since the Yamomoto et al. device is particularly interested in the precise control of the piston and the prevention of collision, it would have been obvious to one of ordinary skill in the art to calibrate the input power to piston displacement. In other words the compressor driving unit would have been capable of supplying a precise amount of power to produce a precise piston displacement. Without this ability the Yamamoto et al. device would be uncontrollable or unpredictable and therefore inoperative.

Heymans et al. in Figure 1 and 3, teach an analogous linear motor compressor with a piston (6), an armature (12), a stator (14), a movable core (24), and two externally energized coils (16a). The Heymans et al. device teaches a control system where the power input to the compressor is detected in order to find the resonant or optimum operational frequency and therefore the most optimum drive power (see column 3 line 50 – column 4 line 10). In order to accomplish this, the output terminals of the energized coils (16) are connected to an inverting and non-inverting differential amplifier (46) for measuring the voltage across the motor. After such rectification, the signal is fed to a multiplier (47), where the signal is indicative of the power consumption of the motor. The signal is also passed to a low-pass filter (48), and various analog-digital converters for smoothening the rectified differential signal. The differential signal from the differential amplifier (46) is proportional to a change in the position of the core by magnetic coupling between the core and the coils. The system determines the

maximum instantaneous amplitude of current and voltage. It is taught that this whole process of determining optimal frequency and power is useful in determining the maximum amplitude of the piston, column 4 line 8. Therefore it would have been obvious to one of ordinary skill in the art at time the invention was made to modify the Yamomoto et al. device by incorporating the Heymans et al., differential amplifier optimum power and piston amplitude calculating system to determine piston amplitude, as taught by Heymans et al., in order to determine piston amplitude and operate the compressor efficiently. By determining the instantaneous power to the motor, a calculation of amplitude and displacement can be obtained, as taught by Yamamoto et al. As the amplitude and displacement is obtained as taught by Heymans et al., the Yamamoto et al. collision detection, and drive units function as disclosed.

***Response to Arguments***

6. Applicant's arguments filed 4/25/2005 have been fully considered but they are not persuasive with respect to claims 5, 22, 25, and 26. The applicant argues that the pump in Yamamoto et al. Figure 1 does not have a valve. The pump would not function without a valve. Although not enumerated Figure 1 does show a valve at the top of cylinder 11 (shown symbolically). Figure 4 depicts in detail pump valves (15 and 16).

The unit in Yamamoto et al. that compares the upper dead point position and an upper dead point reference value constitutes a collision detection unit. One of ordinary skill in the art would have appreciated that if the upper dead point position exceeded the

upper dead point reference value, a collision would be imminent. The system is designed to prevent over stroke under normal operation. Process events such as a sudden head pressure surge or decline are abnormal events that could cause a piston collision. At the time of collision, the Yamamoto et al. apparatus is capable of detecting an upper dead point position greater than an upper dead point reference value or equal to the dead point reference value with the reference value set to the position of the valve plate. One of ordinary skill in the art would have known that a collision would occur if the upper dead point position excessively exceeds the upper dead point reference value. The system therefore constitutes a collision detection unit.

### *Allowable Subject Matter*

7. Claim3, 4, and 11 are allowed.

8. Claim 12 would be allowable if rewritten to overcome the objections, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

### *Conclusion*

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following references are cited to further show the state of the art with respect to collision detection and control systems for linear compressors/motors.

U.S. Pat. App. 2002/0064461 A1 to Yoo et al. – teaches the general nature of the art.

U.S. Pat. App. 2003/0129063 A1 to Jeun – teaches a device for controlling the piston position in a linear compressor by comparing phase differences in square waves indicative of supply current and piston stroke.

U.S. Pat. 6,663,348 to Schwarz et al. – teaches a device for preventing piston collision by measuring the movement time of the piston, comparing the movement time with a foreseen movement time, and altering the voltage of the if the times are outside a given threshold.

U.S. Pat. 5,980,211 to Tojo et al. – teaches gradual modification of compressor drive frequency and amplitude to match reference values in order to prevent piston collision. A current instruction value is compared to a current amplitude of the piston.

U.S. Pat. 5,496,153 to Redlich – teaches the evaluation of the alternating and average components of the piston position by direct measurements of voltage and current.

U.S. Pat. 5,342,176 to Redlich – teaches a method of measuring the distance between the piston top dead center and the valve plate.

U.S. Pat. 6,074,172 to Huang – teaches the general nature of the art.

10. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

***Contact Information***

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Emmanuel Sayoc whose telephone number is (571) 272 4832. The examiner can normally be reached on M-F 8-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy S. Thorpe can be reached on (571) 272-4444. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Emmanuel Sayoc
Examiner
Art Unit 3746

ECS

**Timothy S. Thorpe**
**Supervisory Patent Examiner**
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